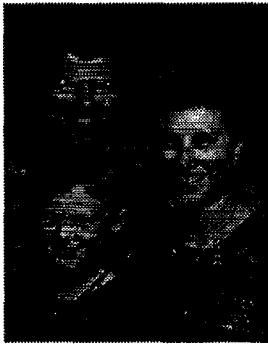


● **Back to Perchlorate Page**

**"Latest Perchlorate News" by Larry Ladd [llladd@sprintmail.com](mailto:llladd@sprintmail.com)**



Larry (pictured with Melody Ladd, daughter, and Deborah Barrell, wife) is a medical geographer serving as a volunteer community representative on the Aerojet Superfund Site Health Assessment Team in Rancho Cordova, California.

- [Perchlorate Distribution in the USA](#)
- [Origin of the Perchlorate Problem](#)
- [Does Perchlorate React in the Human Body?](#)
- [March 1999 - Perchlorate Conference in Ontario, CA](#)
- [Known Areas of Perchlorate Contamination, February 1, 1999](#)
- [Perchlorate Reference Dose / What is A Perchlorate Reference Dose?](#)
- [Perchlorate and Legal Immunity](#)
- [Perchlorate Peer Review](#)
- [Congenital Hypothyroidism Rate in Perchlorate-Contaminated Area](#)
- [Perchlorate Effects on Rat Thyroid](#)

**SPECIAL NOTE:** The US EPA's proposed reference dose for perchlorate in drinking water is 32 ppb (parts per billion) for adults. Depending on which model is used, safe levels of consumption for infants and children can be close to an order of magnitude lower than the adult limit. Many members of a preliminary external peer review panel convened in February felt the EPA's safe levels for ClO<sub>4</sub><sup>-</sup> were not supported by the available data, and should be raised. All parties agreed that data from human experiments was needed to make a firm decision, and that information will be available when another external peer review convenes in January, 2000.

**PERCHLORATE DISTRIBUTION IN THE USA**

[Alabama](#) [Alaska](#) [Arizona](#) [Arkansas](#) [California](#) [Colorado](#) [Connecticut](#) [Delaware](#) [Florida](#) [Georgia](#) [Hawaii](#) [Idaho](#) [Illinois](#) [Indiana](#) [Iowa](#) [Kansas](#) [Kentucky](#) [Louisiana](#) [Maine](#) [Maryland](#) [Massachusetts](#) [Michigan](#) [Minnesota](#) [Mississippi](#) [Missouri](#) [Montana](#) [Nebraska](#) [Nevada](#) [NewHampshire](#) [New Jersey](#) [NewMexico](#) [New York](#) [NorthCarolina](#) [NorthDakota](#) [Ohio](#) [Oklahoma](#) [Oregon](#) [Pennsylvania](#) [RhodeIsland](#) [SouthCarolina](#) [SouthDakota](#) [Tennessee](#) [Texas](#) [Utah](#) [Vermont](#) [Virginia](#) [Washington](#) [WestVirginia](#) [Wisconsin](#) [Wyoming](#) / [Puerto Rico](#)

Note: California water utilities are required to test for perchlorate by the end of 2001; a national survey by

the American Water Works Association Research Foundation will be available in the spring of 2001; national surveillance testing by US EPA is scheduled to be conducted between 2001 and 2003.

## **I. THE EAST**

### **A. EPA REGION II -- THE BIG APPLE & ENVIRONS**

#### **1. New York:**

- Hooker Chemical, Niagara Falls NY - Full scale US military production of perchlorate began here in 1940, and continued until 1975. Since 1968, Hooker Chemical has been a subsidiary of Occidental Petroleum of Los Angeles, CA. Yes, these are the folks who brought you Love Canal.
- Westhampton Beach, Suffolk County, Long Island - A complete survey by the county water department found one well contaminated with over 100 ppb perchlorate from an old BOMARC missile site, but the department claims the drinking water served was diluted below New York's provisional reference dose of 18 ppb. Just below 10% of the county's wells contained perchlorate below 10 ppb, possibly from contaminated nitrate fertilizer. However, the nitrate fertilizer alibi has recently come under scientific attack. Search <http://www.scwa.com/pressrel.htm#latest>

#### **2. New Jersey:**

- Fairmount Chemical, Newark NJ
- H. Reisman Corp., 377 Crane St., Orange NJ 07051
- U.S. Army Tank Automotive and Armaments Command, near Mount Hope, NJ. Contact: Terry Tighe 810-574-5262
- Standard RWY Fusee Co., Boonton NJ
- Hummel Croton, Inc. P.O. Box 250, South Plainfield NJ 08344-0768
- Shieldalloy Corp., 12 West Blvd. PO Box 768, Newfield NJ 08344-0768

**3. Puerto Rico: No data.** The absence of data is no sign that perchlorate contamination does not exist in the region.

### **B. EPA REGION III: CHESAPEAKE AND DELAWARE BASINS**

**1. Delaware: No data.** The absence of data is no sign that perchlorate contamination does not exist in the region.

**2. Virginia:** Chilean nitrate fertilizer tainted with perchlorate is known to have been used in the cultivation of tobacco.

- Atlantic Research, 5945 Wellington Road, Gainesville VA 22065 (20155 zip also given)  
703-754-5316  
Tim Holden, Environmental contact: 703-754-5106 Produces the MLRS using HTPB AP based propellant - still planning to open burn this material. (Suburban Washington DC near Bull Run battlefield. Research facility in Arkansas contaminated water supply for East Camden to ~100 ppb)
- A & B Chemical, 2931 Second Avenue, Suite 100, Richmond VA 23222  
(Has plant in Ogden UT)
- Defense General Supply, 8000 Jefferson Davis Highway, Richmond VA 23297
- Hercules Powder Company, Pepper VA (Have not located yet.)
- Defense General Supply Yorktown plant, Yorktown VA (Chesapeake Bay).

- Paige Ireco (formerly Gibson Explosives), PO Box 33, Duffield, VA 24244 (In the Appalachian mountains of southwest Virginia).
- Radford Army Ammunition plant. Recent incidence of thyroid medical procedures in West Virginia immediately down the New River from this facility is unusually high, but I know nothing of the volume or method of disposal of perchlorate in Radford.

### 3. Maryland:

- Thiokol Corporation, P. O. Box 241, Elkton MD 21922
- New Jersey Fireworks, Elkton MD
- Aberdeen Proving Ground, Ken Stachiw, 410-436-3320 (Elkton and Aberdeen are at the north end of Chesapeake Bay)
- Samuel Jackson Fusee Co., Easton MD (Eastern Shore)
- Naval Surface Warfare Center, 202 Strauss Ave., Indian Head, MD 20640 (Potomac River below Washington, DC)
- Naval Surface Warfare Center, 10901 New Hampshire Ave., Silver Springs MD 20903
- Alliant Tech Systems (formerly Hercules Powder, currently headquartered in West Virginia), Cumberland MD (Potomac River above Washington, DC; see also West Virginia)

### 4. Pennsylvania:

- Aerial Arts, Hatfield, PA (Corporate Headquarters for Aerial Arts is 18355 165th NE, Foley, MN)
- Service Chemical, Telford, PA (Both Aerial Arts and Service Chemical lie some 20 miles northwest of the Philadelphia metropolitan area, near the Bucks County-Montgomery County line)
- Naval Inventory Control Point, Mechanicsburg PA (Suburb of Harrisburg)
- Atlas Powder Co., PO Box 271, Tamaqua PA 18252
- Explo-Tech, Inc., Mt. Carmel PA (A subsidiary of An/Gel Int, 33 C Street, Salt Lake City, Utah 84103) (Both Mt. Carmel and Tamaqua are in the Appalachians along Interstate 81, southeast and south respectively, of Hazleton, PA)
- KESCO Inc., Kittanning, PA. Corporate HQ: PO Box 95, Adrian PA 16210-0095 (Kittanning is on the Allegheny River northeast of Pittsburgh).

### 5. West Virginia:

- Water supply from New River? See Radford, VA
- Naval Industrial Reserve Ordnance Plant
- Alliant Tech Systems
- Allegheny Ballistics Laboratory, 210 State Route 956, Rocket Center, WV 26726 Tel. 304-726-5000 Near Keyser WV, up Potomac watershed from Cumberland, MD. A new machining facility is driving Alliant's need to dispose of ammonium perchlorate in an "energetic environment," i.e. where there is danger of it being ignited.
- Appalachian Explosives, Romney WV (up Potomac watershed from Cumberland, MD; owned by An/Gel Int, 33 C Street, Salt Lake City, UT 84103)
- Newell Specialties, State Route 2, Newell WV 26050 (On Ohio River near Ohio-Pennsylvania border)
- West Virginia environmental regulators have confirmed that perchlorate contamination of groundwater is present at two of the above sites.

## C. EPA REGION V: GREAT LAKES

### 1. Ohio:

- Hilltop Energy Inc., Lisbon OH (A subsidiary of An/Gel International, 33 C. St., Salt Lake City, UT)
- Barium & Chemicals, Steubenville OH
- Servo Dynamics, Marietta OH, Corporate HQ: Rt. 1, Box 132 E. Roddfield, Corpus Christi TX 78414
- Fanaco, Inc. Cincinnati OH  
(All of the above are on or near the Ohio River)
- Standard RWY Fusee Co., Fostoria OH (Northeast of Findlay, OH)
- Austin Powder, 25800 Science Park Drive, Cleveland Ohio 44122
- G. F. Smith Chemicals, Columbus - Corporate HQ: PO Box 245, Powell OH. G. F. Smith is the original US manufacturer of perchlorate, starting production in 1928.

### 2. Michigan:

- Ireco, Inc., Ishperning MI, Corporate HQ: 11th Floor, Crossroads Tower, Salt Lake City, UT 84144 (Upper Peninsula, Lake Superior side, near Marquette)

### 3. Indiana:

- Olin Corp., RR 6 Box 542, Peru IN 46970
- (Given the grouping of the auto sealant division of Gencorp with Aerojet in the pending corporate spinoff, and the joint use of the Batesville, Arkansas facility by both sealant and ordnance divisions, the Gencorp plants at Wabash and Marion IN upstream from Peru may also be a problem.)
- Crane Naval Weapons Support Center, 300 Highway 361, Crane IN 47522. Contact: Dan Burch. Tel. 812-854-3505. Email [db3739@smtp.nwscc.sea06.navy.mil](mailto:db3739@smtp.nwscc.sea06.navy.mil) Generates wastewater from conventional weapons demilitarization.
- (Peru is along the upper Wabash River, midway between Indianapolis and the Michigan border; Crane is southwest of Bloomington and lies adjacent to the Greenwood Reservoir, which feeds into the White and Wabash Rivers. Fireworks factories in Danville, IL also probably dump into the Wabash)
- Melrose Fireworks, PO Box 302, Kingsbury IN 46345
- Aerial Dynamics, PO Box 304, Kingsbury IN 46345
- Kingsbury Industries, Kingsbury IN 46345 (Kingsbury is just beyond the Chicago metropolitan area, south of La Porte, IN and about 5 miles from the Kankakee River.)

### 4. Illinois:

- Harold Dunbar Paper Company, Chicago IL
- Talley Defence Systems, Joliet IL Corporate HQ: PO Box 849, Mesa AZ (Joliet is on the Des Plaines River, near the junction with the Kankakee River that forms the Illinois River).
- Lakeside Fusee, South Beloit IL (Where the Rock River crosses the Illinois-Wisconsin line).
- Savanna US Army Defense Ammunition Center, 3700 Army Depot Road, Savanna IL 61074-9639. Large rocket motor and conventional ordnance disposal. Contact Jim Wheeler, 815-273-8084. (Perchlorate at a few parts-per-billion has been detected in drinking water in Clinton and Davenport, Iowa, just down the Mississippi River from this facility)
- World Fireworks, Danville IL

- Star Fireworks, Danville IL (Danville is on the Illinois-Indiana border, where the Vermillion River flows into the Wabash River).
- Propellex, PO Box 387, Edwardsville, IL 62025 (Edwardsville is a suburb northeast of St. Louis)
- Olin Corporation, PO Box 278, Marion IL 62959 (Olin is adjacent to Crab Orchard Lake, which I was always told provided the water for Carbondale, my old Southern Illinois hometown. Yes, my mother has thyroid and autoimmune problems -- so does my uncle who worked as a yeoman at the Las Vegas Navy facility that made this stuff during World War II. He also lived most of his life in Orange County, CA, drinking Colorado River water that has contained perchlorate for who-knows-how-long. Then there's my aunt with thyroid problems in Greenwood, IN, where low levels of perchlorate were found in the drinking water. All of these water-borne exposures are probably much smaller than what is found in most lettuce in this country. The bottom line is that perchlorate is ubiquitous, and whether chronic exposure to ClO<sub>4</sub><sup>-</sup> has anything to do with thyroid disease remains to be seen. The conventional wisdom is that there is no connection, but we don't know diddly about perchlorate-vanadium interactions in the thyroid, so there are no guarantees. Until we can track where perchlorate is in the food and water supply and look for correlations with thyroid ailments, it's just a disturbing question that the authorities want to avoid.)

#### 5. Wisconsin:

- Bartolotta Fireworks, Delafield, WI Corporate HQ: Ireco Inc. (formerly Pacific Powder) 628 Columbia, NW, Suite 1-A Olympia, WA 98501 (Delafield is 20 miles west of Milwaukee on Interstate 94)

#### 6. Minnesota:

- Nitrochem Energy Corp., PO Box B, Biwabik MN 55708
- Thermex Energy, Biwabik MN 55708 Corporate HQ: 13601 Preston Road, Suite 900 W., Dallas TX 75240
- Cook Slurry, Gilbert MN Corporate HQ: Cook Associates, 2026 Beneficial Life Tower, 3650 State St., Salt Lake City, UT 84111 (Biwabik and Gilbert are part of the Mesabi Range mining district.)
- Aerial Arts, 18355 165th St. NE, Foley MN 56329 (Foley is 15 miles northeast of St. Cloud in central Minnesota).

### D. EPA REGION I: NEW ENGLAND

The absence of data is no sign that perchlorate contamination does not exist in the region. All this void indicates is that no perchlorate was shipped to munitions, explosives, or fireworks factories in New England during the 1990s. So any contamination that does exist probably comes from decades-old industrial activities -- in some parts of Southern California the perchlorate groundwater plumes are 40 years old and have drifted 15 miles from their point of origin.

**1. Connecticut: No data.** The absence of data is no sign that perchlorate contamination does not exist in the region.

**2. Rhode Island: No data.** The absence of data is no sign that perchlorate contamination does not exist in the region.

#### 3. Massachusetts:

- The Silent Spring Institute has informed me they plan to have drinking water at Cape Cod checked

for perchlorate.

**4. New Hampshire: No data.** The absence of data is no sign that perchlorate contamination does not exist in the region.

**5. Vermont: No data.** The absence of data is no sign that perchlorate contamination does not exist in the region.

**6. Maine: No data.** The absence of data is no sign that perchlorate contamination does not exist in the region.

## II. THE SOUTH

### A. EPA REGION VI: DIXIE WITH OIL

#### 1. Oklahoma:

- Probably the biggest perchlorate hotspot in this part of the midwest is around Joplin, MO: Thermex (formerly Gulf Oil), in Hallowell, KS; Corporate HQ: 13601 Preston Rd., Suite 900 W, Dallas TX 75240; also in Hallowell, Slurry Explosives (formerly El Dorado) is listed with corporate HQ at PO Box 348, Columbus KS 66725. The Hallowell plants may feed into the Lightning River, which immediately flows across the state line to the Miami, OK area. The Spring River likewise joins the Lightning River at the Grand Lake of the Cherokees -- that might be an interesting waterbody to sample. Atlas Powder appears to have two plants, one in Atlas, MO and one in Joplin proper -- Corporate HQ is at PO Box 87, Joplin MO 64801; then there is also an ICI (Imperial Chemical Company?) plant in Joplin, with corporate HQ at PO Box 819, Valley Forge PA 19482.

#### 2. New Mexico:

- Longhorn Manufacturing Company/Longhorn Army Ammunition Plant, Roswell NM (Perchlorate has been used in many areas at Longhorn both with the Pershing and base burner.)
- Cannon Air Force Base, Clovis NM
- White Sands Missile Range (Tests large rockets and motors; the range lies between the Rio Grande River and Alamogordo, NM). State authorities confirm 21 ppb in open burn area.
- Aerojet Ordnance Facility, Socorro, NM next to Rio Grande River
- Perchlorate said to exist in langbeinite mined as potash in Carlsbad area. This formation is limited to Eddy County and the adjacent Texas border. State water authorities informed me that groundwater is used for drinking in this arid county, so the potential exists for an epidemiological study of long term exposure to perchlorate in drinking water.

**3. Texas:** Perchlorate-tainted nitrate fertilizer from Chile has been used on cotton. There is also some suggestion that surplus sodium perchlorate was sometimes informally used as cotton defoliant.

- Alliant Tech (formerly Hercules, Inc.) McGregor, TX ( Small amounts of perchlorate in creeks adjacent to this shutdown facility; major cleanup in store on-site; McGregor is about 15 miles southwest of Waco.)
- M & M Chemical, 103 Stovall, Waco TX 76706
- Servo Dynamics, Inc. Rt. 1, Box 132 E. Roddfield, Corpus Christi, TX
- Thermex (formerly Gulf), Houston TX Corporate HQ: 13601 Preston Road, Suite 900 West, Dallas TX 75240

- Slumberger, PO Box 1590, Rosharon, TX 77583 (Rosharon lies between Houston and Galveston)
- Shaped Charge Specialists, Mansfield TX
- Harrison Jet Guns, 6915 Hudson Village Creek Rd., Kennedale TX 76060 (Mansfield and Kennedale are southern suburbs of the Dallas-Fort Worth metro area)
- RTF Enterprises, Marshall TX
- Closed Thiokol facility, Karnak TX (Perchlorate from the Marshall-Karnak area has been found in Caddo Lake, on the Texas-Louisiana border northwest of Shreveport, LA)
- Water supply from upper Rio Grande? See Socorro, NM

**4. Louisiana:** Perchlorate-tainted nitrate fertilizer from Chile has been used on cotton. There is also some suggestion that surplus sodium perchlorate was sometimes informally used as cotton defoliant.

- (Perchlorate probably enters Louisiana from East Camden, Arkansas via the Ouachita River, but since this river contains other contaminants from wood pulp factories it is not used as a drinking water source.)
- Bartlett Chemicals, New Orleans

**5. Arkansas:** Perchlorate-tainted nitrate fertilizer from Chile has been used on cotton. There is also some suggestion that surplus sodium perchlorate was sometimes informally used as cotton defoliant.

- Atlantic Research Corp., East Camden AR 71701 Corporate HQ: PO Box 1036, Camden AR 71701 (Uses large amounts of perchlorate; well in East Camden contaminated to 100 ppb level)
- Aerojet Ordnance facility located at Camden from 1965-1974. State water authorities have declined to give details of this exposure.
- Mining Services International, East Camden AR 71701
- Hitech Inc., Woodbury AR Corporate HQ: PO Box 3112, East Camden AR 71701 (Woodbury is the next town to the east of East Camden).
- Pine Bluff Arsenal on Arkansas River.
- SECO Inc., Midland AR Corporate HQ: Austin Powder, 25800 Science Park Drive, Cleveland Ohio 44122 (Midland is near the Oklahoma-Arkansas border, about 20 miles south of Fort Smith.)
- Aerojet Ordnance facility in Batesville, 1965-1974, in Ozarks west of Jonesboro.

## **B. EPA REGION IV: DIXIE WITHOUT OIL**

**1. Mississippi:** Perchlorate-tainted nitrate fertilizer from Chile has been used on cotton. There is also some suggestion that surplus sodium perchlorate was sometimes informally used as cotton defoliant.

- Aerojet at former Yellow River Nuclear Power plant, Iuka MS 1988-1993 on Tennessee River
- Hooker Chemical (now Eka Nobel) produced tons of perchlorate 1958-1965 in Columbus
- Rebel Fireworks at Foxsworth near Columbia on the Pearl River

**2. Alabama:** Perchlorate-tainted nitrate fertilizer from Chile has been used on cotton. There is also some suggestion that surplus sodium perchlorate was sometimes informally used as cotton defoliant.

- Major complex (Thiokol, etc.) around Huntsville/Redstone Arsenal on Tennessee River.
- Boren Ireco in Parrish and Hercules/Alliant Tech in Bessemer, both west of Birmingham. Black Warrior River may be contaminated in vicinity of Tuscaloosa.

**3. Florida:** University of Florida Agriculture Extension publications have indicated that perchlorate contamination has been a problem in some of the state's orange groves.

- Florida has Eglin AFB and Patrick AFB
- Thermex Energy in Brooksville (some 35 miles north of Tampa), corporate HQ 13601 Preston Road, Suite 900 West, Dallas, TX 75240;
- and finally, the enigmatic CCT in Hollywood between Fort Lauderdale and Miami.
- Aerojet rocket testing facility near Homestead AFB in Dade County next to Everglades.

**4. Georgia:** Perchlorate-tainted nitrate fertilizer from Chile has been used on cotton. There is also some suggestion that surplus sodium perchlorate was sometimes informally used as cotton defoliant.

- ICI in Byron, south of Macon

**5. South Carolina:** Perchlorate-tainted nitrate fertilizer from Chile has been used on cotton. There is also some suggestion that surplus sodium perchlorate was sometimes informally used as cotton defoliant.

- Phillips Components, Columbia

**6. North Carolina:** Chilean fertilizer allegedly contaminated with perchlorate has been used in the cultivation of tobacco.

- Atlas Powder, Riegelwood near Cape Fear River north of Wilmington
- Gulf Oil, McCleansville, south of Chapel Hill near New Hope Reservoir

#### **7. Tennessee:**

- Southwestern Energy, An / Gel, east of Lenoir City near eastern Tennessee River.
- Kilgore Corp., Toone, near Trenton and Forked River. Western Tennessee River?, see Mississippi and Alabama.

**8. Kentucky:** Perchlorate-tainted nitrate fertilizer from Chile is still used on tobacco.

### **I. THE WEST**

#### **A. REGION IX - SUNNY PACIFIC**

**1. California:** Latest test results --

[http://www.dhs.cahwnet.gov/ps/ddwem/chemicals/perchl/perchl\\_overview.htm](http://www.dhs.cahwnet.gov/ps/ddwem/chemicals/perchl/perchl_overview.htm) All major drinking water sources in California must be tested for perchlorate by the end of 2001. Partly out of a fear of personal injury suits, testing and reporting for perchlorate has lagged far behind testing for NDMA. In the last 6 months half the water sources in the state have tested for NDMA, but only the university towns of Pasadena and Pomona have recently tested and reported perchlorate. The existence of perchlorate in most of the drinking water for San Diego and Orange counties is not even mentioned at the above site. Citizens of Orange County are, however, wary of perchlorate from El Toro: Search <http://www.ocregister.com/archives>

California has so many places listed I'll just type the towns:

- Aliso
- Viejo
- Auburn, Barstow (2 sites), China Lake, Edwards AFB

- Gardena, Hollister (3 sites, including highest levels found in drinking water so far - 810 ppb)
- Huntington Beach
- Ione
- Llano
- Long Beach
- Middletown
- Morgan Hill
- Rancho Cordova (that's me)
- Norwalk
- Ontario
- Pasadena (JPL)
- Pomona (low levels all over that town; Earl Hines, an environmental engineer with the Colorado Indian tribes, grew up there and he has Hashimoto's)
- Redwood City
- Rialto
- Riverside (2 sites), San Jose (United Technologies -- actually in the mtns. just north of Morgan Hill, with a little leakage into the Morgan Hill reservoir
- Saugus (2 sites; Whitaker Bermite -- that's now Santa Clarita I think)
- Tracy (Lawrence Livermore lab)
- Whittier
- Windsor
- Western Electro Chemical Company started perchlorate production in Los Angeles proper in 1941 and then shifted operations to Las Vegas in 1952 ; the sole remaining perchlorate manufacturer in this country, American Pacific, originated from Western Electro.
- Sierra Army Depot, rocket motor treatment. Vandenburg AFB disposal of perchlorate since 1942

## 2. Nevada:

- Largo Marsino in Lockwood
- BOKMA in Fernley
- Las Vegas metropolitan area (not news to anybody there!)
- Hawthorne Army Depot.

## 3. Arizona: Fact sheet at - <http://www.adeq.state.az.us/water/safe/fact.htm>

- Colorado River Aqueduct and associated crops. Excess sodium perchlorate from Las Vegas was allegedly used as a defoliant on cotton.
- Aerodyne in Tempe and Chandler
- Unidynamics in Goodyear
- Talley Defense in Mesa
- Universal Propulsion in Phoenix
- Yuma Proving Ground.

**4. Hawaii:** No data. The absence of data is no sign that perchlorate contamination does not exist in the region.

## B. REGION VIII - ROCKY MOUNTAINS AND GREAT PLAINS

**1. Utah:** Utah is the national center for perchlorate production in the 1990s.

- American Pacific, Cedar City
- Alliant Tech in Magna
- Thiokol in Brigham City
- Fireworks West in Logan
- Dyno Nobel and Atlas Powder in Lehi
- Defense General Supply and A& B
- Chemical in Ogden
- Dyno Nobel and Hanex in Salt Lake City
- Tooele Army Depot
- Hill AFB
- Utah Test and Training Range -- Rocket demilitarization at Thermal Treatment Unit

## 2. Colorado:

- Estes Model Rockets, Penrose
- Gateway Safety, Englewood
- KSI, Whitewater
- Vulcan Systems, Colorado Springs.

## 3. Wyoming:

- Thermex in Mills.

**4. Montana:** No data. The absence of data is no sign that perchlorate contamination does not exist in the region.

## 5. North Dakota:

- Fargo is the place! Starr Display in Harwood upstream of Fargo on the Red River and in Fargo proper.
- Then there's Dakota Pyrotechnic just southwest of Fargo in Harwood.

**6. South Dakota:** No data. The absence of data is no sign that perchlorate contamination does not exist in the region.

## C. REGION X - CLOUDY PACIFIC

### 1. Idaho:

- Firefox Enterprises in Pocatello

### 2. Oregon:

- Major historical (1958-1965) ClO<sub>4</sub>- production facility at Pennsalt, now Elf Atochem, in Portland.

### 3. Washington

- Ireco Inc. (formerly Pacific Powder) 628 Columbia NW, Suite 1-A, Olympia WA 98501

**4. Alaska:** No data. The absence of data is no sign that perchlorate contamination does not exist in the

region.

## D. REGION VII - HEARTLAND

### 1 & 2. Kansas & Missouri: High nitrate wells in Kansas? See Nebraska.

- Hodgdon Powder, a subsidiary of Pyrodex, in Herrington about 25 miles south of Junction City/Manhattan near the Lyon River.
- Probably the biggest perchlorate hotspot in the part of the midwest is around Joplin, MO: Thermex (formerly Gulf Oil), in Hallowell, KS; Corporate HQ: 13601 Preston Rd., Suite 900 W, Dallas TX 75240; also in Hallowell, Slurry Explosives (formerly El Dorado) is listed with corporate HQ at PO Box 348, Columbus KS 66725. The Hallowell plants may feed into the Lightning River, which immediately flows across the state line to the Miami, OK area. The Spring River likewise joins the Lightning River at the Grand Lake of the Cherokees.
- Atlas Powder appears to have two plants, one in Atlas, MO and one in Joplin proper -- Corporate HQ is at PO Box 87, Joplin MO 64801;
- then there is also an ICI (Imperial Chemical Company?) plant in Joplin, with corporate HQ at PO Box 819, Valley Forge PA 19482.

### 3. Iowa:

- Iowa had some low-level hits (2-5 ppb) in Davenport and Clinton's water supply; this was a private water company's (American Water Works) survey, so these may be the only towns sampled. These hits maybe from Savanna Army facility on Mississippi River. See Illinois.

**4. Nebraska:** In Nebraska and Kansas the US EPA was supposed to be checking high nitrate wells for ClO<sub>4</sub><sup>-</sup> using an Air Force lab, so contact EPA Region VII to get the latest info. I hear they found nothing above 4 ppb except for one shallow

## ORIGIN OF THE PERCHLORATE PROBLEM

The "discovery" of drinking water contaminated with the solid rocket fuel component perchlorate and the liquid rocket fuel component nitrosodimethylamine is a legacy of the Sewergate scandal of 1983. The principal figure in that affair was Rita Lavelle, head of the Superfund and former manager of the Aerojet Liquid Rocket Testing Facility in Rancho Cordova. The ion chromatography (IC) method used to measure perchlorate to a level of 200 parts-per-billion was available in 1983, although a lab technician in that year would have to wait an hour to get the results for perchlorate. Adjustments in IC plumbing and measurement time were made in 1986 so that the FBI Crime Lab could use the technique in criminal cases involving explosives. As this new IC technology was being developed, a Superfund consent decree mandated an erratic, unreliable, and obsolete ion specific electrode method for monitoring parts-per-million perchlorate plumes that migrated off of the Aerojet Superfund site into Rancho Cordova. EPA investigators concerned about perchlorate in the San Gabriel Valley were told to turn their attention to more important problems. This allowed the perchlorate problem to remain undetected for a decade, and as a result

some residents of the San Gabriel Valley were exposed to close to a 1-in-500 cancer risk from the liquid rocket fuel component nitrosodimethylamine (NDMA) in their drinking water.

If perchlorate had been properly monitored in 1986, its detection in both Rancho Cordova and the San Gabriel Valley would have prevented the more dangerous drinking water exposures to NDMA from Lavelle's former Aerojet workplace. The week the existence of perchlorate in drinking water was first made public (March, 1997), the president of Aerojet announced his plans to retire and Mr. James Strock resigned. Strock was head of the California Environmental Protection Agency, and former head of the enforcement division of the US EPA (see <http://www.strock-california.com> ).

For information on the history of ion chromatography, contact Dr. Peter Jackson of Dionex Corporation in Sunnyvale, CA. For information on Sewergate and Aerojet, search for Rita Lavelle at <http://rtk.net/E10049T609> .

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## DOES PERCHLORATE REACT IN THE HUMAN BODY?

### > What's Known

>

> It's well-established that at least 99% of large doses of perchlorate simply pass out of the human body unaltered. What is still unknown to the public is whether perchlorate consistently reacts with any human enzyme.

>

> If perchlorate does react systematically, at a low rate, with one or more select enzymes, then it's possible that the critical effect of perchlorate toxicology has not yet been identified. In such a scenario the ill effects of perchlorate toxicology might be more dependent on time rather than the size of the dose. Data on this question should be available in January, 2000, when the results of perchlorate experiments conducted at Harvard will be made public. One of these experiments involves human subjects consuming large doses of radioactively-labeled perchlorate ( $\text{ClO}_4^-$ ), and then testing the subjects' urine. If radioactive chloride ( $\text{Cl}^-$ ) or ( $\text{ClO}_3^-$ ) are found in the urine in the part-per-billion range, then the potential exists that perchlorate is systematically reacting with some enzyme in the body. Further research would have to be conducted to determine if this reaction is random or concentrated. Random parts-per-billion reactions of perchlorate with bacteria in the human gut or human tissue should not present a significant health hazard.

>

> Many enzymes such as catalases and peroxidases are designed to remove

- > an oxygen from an atom that is fully oxygenated. Usually these enzymes
- > are used to convert hydrogen peroxide ( $\text{H}_2\text{O}_2$ , a byproduct of human
- > biochemistry) into harmless water ( $2 \text{H}_2\text{O}$ ) by removing an oxygen from
- > the hydrogen peroxide via the simultaneous addition of two hydrogen ions
- > (acid) and two electrons. Catalases can perform this reaction millions of
- > times a minute. A process that converts hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) into
- > water ( $2 \text{H}_2\text{O}$ ), if successfully applied to perchlorate ( $\text{ClO}_4^-$ ), would create
- > chlorate ( $\text{ClO}_3^-$ ). Chlorate is much more reactive than perchlorate, and can
- > be characterized as double-strength bleach. The US EPA's safe level for
- > chlorate is in the 1000 part-per-billion range, while the proposed
- > reference dose for perchlorate is 5 to 32 ppb. The less-reactive
- > substance has a tougher concentration limit because there is some concern
- > is that perchlorate could be a toxicological "Trojan horse" that reaches
- > sensitive tissues and then turns into chlorate, while 1 ppm  $\text{ClO}_3^-$  directly consumed
- > would harmlessly react in the throat and gut before doing serious damage.

### > A Disaster Scenario

- >
- > A scary hypothesis that needs to be ruled out: perchlorate reacts at a low rate
- > with the enzyme thyroid peroxidase (TPO) and other vanadium-utilizing enzymes.
- > Thyroid peroxidase converts iodide into thyroid hormone, so the body directs a
- > stream of concentrated iodide towards it. This iodide-concentrating system also
- > concentrates perchlorate, so it is presumed that if  $\text{ClO}_4^-$  is present in the human
- > blood stream it too will be directed towards thyroid peroxidase. One of the reasons
- > this hypothesis is provocative is that antibodies to thyroid peroxidase are a precursor
- > to common autoimmune thyroid ailments like Graves disease (hyperthyroidism) and
- > Hashimoto's thyroiditis (hypothyroidism).

- >
- > A disaster scenario would be that thyroid peroxidase converts enough
- > perchlorate to chlorate to trigger an immune response via chlorate-damaged
- > thyroid peroxidase and thyroglobulin molecules. The business end of thyroid
- > peroxidase consists of the pigment heme, the same iron-rich compound that
- > gives blood its red color via hemoglobin.

- > For a view of the chemical structure of heme see
- > <http://www.chem.arizona.edu/courses/chem242/movies/heme1.mov> .

- > For a view of peroxidase chemistry see
- > <http://bioinf.leeds.ac.uk/promise/PEROXIDASES.html>

- > For a view of the chemical structure of perchlorate see
- > [http://www.lvc.edu/www/Molecules/Images/ANIMATIONS/CLO4\\_.HTML](http://www.lvc.edu/www/Molecules/Images/ANIMATIONS/CLO4_.HTML)

- >
- > In peroxidases a metal (the central green atom in the heme movie)
- > like vanadium or iron is suspended in a ring of nitrogen (blue atoms) and
- > carbon (grey atoms). One key element in reduction of perchlorate is
- > the presence of hydrogen (red atoms). Enzyme construction is complex
- > and usually designed to promote one specific chemical reaction:
- > In red blood cells heme holds oxygen; in thyroid peroxidase an electron is
- > stolen from TPO by the hydrogen-peroxide-to-water

- > conversion process, so that TPO in turn can steal electrons from iodide (I-)
- > to make thyroid hormone. If the colloidal metal (green atom in heme)
- > is able to steal an oxygen from perchlorate (red atom in perchlorate)
- > it would create a chlorate "bomb" that could drift away and damage adjacent
- > molecules, potentially leading to an autoimmune response. If perchlorate reacting
- > with thyroid peroxidase can trigger an immune response, then a Pandora's box
- > of potential ailments is opened. As was stated earlier, thyroid peroxidase antibodies
- > play a central role in thyroid disease, and they are also associated with fertility problems.
- >
- > Is perchlorate capable of reacting with the heme in thyroid peroxidase?
- > If it does, it does not do so at a high rate. Low parts-per-billion
- > concentrations of perchlorate in drinking water do not measurably lower
- > thyroid hormone levels in rats, and thyroid hormones would certainly drop
- > if perchlorate reacted with thyroid peroxidase everytime the two molecules
- > met. Reactibility would depend on the angle and speed of collision, and
- > the simultaneous presence of hydrogen ions (H+) and electrons as determined
- > by the structure of the enzyme. In free dilute solutions such simultaneous multiple
- > collisions are very rare events, so that perchlorate is essentially unchanged and inactive.
- >
- > But it is known from warfare and industrial accidents that solid chunks of perchlorate
- > injected into the blood stream convert hemoglobin (heme with iron at +2 charge)
- > into methemoglobin (heme with iron at +3 charge), a reaction similar to the "arming"
- > of thyroid peroxidase. During the late 1950s-early 1960s a few unfortunate
- > hyperthyroid persons consuming large medicinal doses of perchlorate died from
- > aplastic anemia (lack of red blood cells); the exact mechanism of these deaths is still
- > unknown. The enzymes that bacteria use to breakdown perchlorate often contain heme,
- > although whether iron in this form ever plays a functional as opposed to a structural
- > role is still unclear. US Air Force scientist Cornell Long reported in a recent perchlorate
- > conference that perchlorate appears to react to some extent with iron-manganese
- > nodules in the soil. Iron in the +3 state is known to complex with perchlorate in water,
- > and iron oxide (rust) is used as a catalyst for perchlorate in rocket fuel. Of course,
- > the perchlorate/iron reaction in rockets occurs at extremely high temperatures far
- > above anything found in the human metabolism. Much more likely is the possibility
- > that heme or a similar molecule containing the trace element vanadium would
- > convert perchlorate to chlorate. At some valences, vanadium reacts violently
- > with nitrates and chlorine oxyanions.
- >
- > Despite the circumstantial association between perchlorate and the metals in
- > heme, rat studies conducted so far show no apparent effect of very large doses of
- > perchlorate on heme-rich liver and red blood cells. However, evaluating
- > potential immune effects of perchlorate on rat thyroids is somewhat
- > problematic: Unlike humans, rats do not utilize thyroglobulin to transport
- > thyroid hormone out into the bloodstream. In human thyroid autoimmune
- > disease, thyroglobulin is both an antigen (stimulator of antibody production)
- > and a potential transporter of other protein antigens from the thyroid gland
- > to the blood stream and immune system.

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## MARCH 1999 - PERCHLORATE CONFERENCE IN ONTARIO, CA

On March 18-19 the Metropolitan Water District of Southern California and other utilities held a conference on perchlorate contamination of drinking water. The purpose of the conference was to prepare other water purveyors for the public concern expected when perchlorate appears on drinking water consumer confidence reports. Amongst the new developments:

**HUMAN TESTING:** Dr. Braverman's team at Harvard and Dr. Brabant's team at Munich are currently administering radioactive perchlorate to volunteers. A key finding from these studies will be the amount of radioactive chloride found in the test subject's urine -- if radioactive Cl- is consistently found in the parts-per-billion range, then perchlorate may be systematically reacting with human enzymes. Analysis of the initial results has led to the need for further testing, so that the US EPA's external peer review for a new perchlorate reference dose has been rescheduled from August, 1999 to January, 2000.

**FOOD SUPPLY:** Last month the Chilean nitrate deposits that are mined for fertilizer were tested for perchlorate. The average concentration of ClO<sub>4</sub><sup>-</sup> was found to be .4%. As a consequence, a new perchlorate survey of high-nitrate aquifers in agricultural areas will be conducted this summer by California EPA and the US EPA. California regulators will focus on the San Joaquin Valley, while the federal authorities will be examining groundwater in Kansas and Nebraska. For several months the Department of Defense has been testing food crops for perchlorate accumulation, but so far military scientists have declined to share the initial results of these experiments with the US EPA.

**LITIGATION:** Southern California's discovery of water contamination by perchlorate, nitrosodimethylamine, and 1,4 dioxane has led to something of a legal firestorm. In Redlands, CA alone 6 separate class action suits involving hundreds of plaintiffs have been filed. These suits are independent of the individuals who are claiming personal injury. Water utilities won an initial ruling in district court that they were not liable for the problem, and this question is now being deliberated in appeals court. Water purveyors also sought relief from liability from the California state legislature, but could not find a politician willing to sponsor their proposed law.

Larry Ladd

Community Representative  
Aerojet Health Assessment Site Team  
Rancho Cordova, California

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## KNOWN AREAS OF PERCHLORATE CONTAMINATION / FEB 1, 1999

**(See: Dec 11, 1999 - Rocket Propellant Chemical Found in Drinking Water / ZWA Update 2/2/99: EPA will test wells in the Yardley area. )**

>> From: "Larry Ladd" [llladd@sprintmail.com](mailto:llladd@sprintmail.com) /

>> Community Representative

>> Aerojet Health Assessment Site Team

>> Rancho Cordova, California

>>

>> The largest known point source for perchlorate is the sewage effluent of

>> Las Vegas, NV in the Las Vegas Wash, which contains approximately 1000  
>> ppb ClO<sub>4</sub><sup>-</sup> leached from buried stream beds. The subterranean stream beds in  
>> turn were contaminated by dumping from the Kerr McGee perchlorate plant  
>> in Henderson, Nevada. This factory used the electricity from Hoover Dam to  
>> manufacture most of the nation's perchlorate. Kerr McGee, already  
>> bruised by the Silkwood episode, has withdrawn from the perchlorate business.  
>>  
>> The effluent from Las Vegas flows into Lake Mead and the Colorado River,  
>> contaminating Las Vegas's water supply to a level of 10-20 ppb, and the  
>> drinking water for many communities between and including Los Angeles/San  
>> Diego and Phoenix/Tucson to a level of 5-10 ppb. The level of perchlorate in  
>> Las Vegas's water depends on currents in Lake Mead, so that there has been no  
>> perchlorate in Vegas water since last summer. High summer evaporation  
>> rates in the desert would likely concentrate perchlorate in both irrigation  
>> waters and food crops of the lower Colorado Basin. This source alone has  
>> contaminated the water supply of over 10 million people, and quite possibly  
>> contaminated the food supply of millions more.  
>>  
>> Suffolk County, New York (the eastern 2/3rds of Long Island) has found  
>> perchlorate in the 2-8 ppb range in 5-10% of its wells. One well in  
>> Westhampton Beach contained 150 ppb ClO<sub>4</sub><sup>-</sup> and was shut down.  
>>  
>> In the first nation-wide survey for perchlorate, the American Water  
>> Works Service Company reported finding perchlorate in 10 of the 400 wells they  
>> own. Most of these contaminated wells were in California and part of  
>> groundwater plumes already detected by the state Department of Health  
>> Services, but there were five hits elsewhere: Yardley (Lower Makefield), Pennsylvania (5ppb)  
>> north of Philadelphia and across the Delaware River from Trenton, New  
>> Jersey; Davenport and Clinton, Iowa (up to 6 ppb) along the Mississippi  
>> River; Greenwood, Indiana south of Indianapolis; and Clovis, New Mexico on  
>> the central New Mexico-Texas border, in association with Cannon Air Force Base.  
>>  
>> AWWSC officials in Indiana report that they cannot duplicate their ClO<sub>4</sub><sup>-</sup>  
>> hit. AWWARF, the water purveyor organization given responsibility for  
>> perchlorate research by Congress, is hesitating to survey nationwide until  
>> toxicological studies are finalized. A perchlorate test using ion chromatography costs  
>> \$20 wholesale, \$100 retail. Part of AWWARF's concern is that water  
>> purveyors will find themselves entangled in personal injury suits when perchlorate is  
>> discovered ( see [http://www.rkmlaw.com/as\\_toxic.htm](http://www.rkmlaw.com/as_toxic.htm) ). While the "good  
>> science" on perchlorate's health effects is still pending, AAWARF is  
>> developing a computer model that will enable it to efficiently find ClO<sub>4</sub><sup>-</sup>  
>> in drinking water when the time is right.  
>>  
>> A much-improved list of contaminated wells in California can be found at  
>> [www.dhs.cahwnet.gov/ps/ddwem/chemicals/perchl/perchlindex.htm](http://www.dhs.cahwnet.gov/ps/ddwem/chemicals/perchl/perchlindex.htm). Names,  
>> test dates, and concentrations are available for each well.  
>>  
>> Perchlorate from several munitions and rocket plants is in the groundwater  
>> supply to the west of the Utah urban area. It has only entered the water  
>> supply to a level of 5 ppb in one well in Magna, Utah.

&gt;&gt;

>> Perchlorate at a level of 5 ppb can be found in Caddo Lake on the  
>> Texas-Louisiana border 20 miles northwest of Shreveport, and up to 100 ppb  
>> has been found in the water supply of East Camden, Arkansas, 100 miles to  
>> the northeast of Shreveport. (end)

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## PERCHLORATE REFERENCE DOSE

According to Kevin Mayer of the US EPA, the new reference dose for perchlorate is .0009 mg/kg/day, which yields a drinking water concentration of 32 parts-per-billion in the standard adult exposure model (70kg adult drinking 2L of H<sub>2</sub>O) and 5 parts-per-billion in one of the many infant exposure models that could be used. See the following Reference Dose Announcement for further information.

Larry Ladd

## REFERENCE DOSE ANNOUNCEMENT

This from <http://www.epa.gov/ncea/perch.htm>

Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization Based on Emerging Information (EXTERNAL REVIEW DRAFT)  
PDF Version (Doc Stats: One 335K PDF file)

Perchlorate Environmental Contamination:  
Toxicological Review and Risk Characterization  
Based on Emerging Information

### ABSTRACT:

Perchlorate (ClO<sub>4</sub><sup>-</sup>) is an anion that originates as a contaminant in ground water and surface waters from the dissolution of ammonium, potassium, magnesium, or sodium salts. Because perchlorate is nonlabile kinetically (i.e., the reduction of the central chlorine atom occurs extremely slowly) and sorption or natural chemical reduction in the environment is not significant, perchlorate is exceedingly mobile in aqueous systems and can persist for many decades under typical ground and surface water conditions. Sources for the contamination include chemical fertilizer and various other chemical and industrial uses. One major source of contamination is the manufacture of ammonium perchlorate for use as the oxidizer component and primary ingredient in solid propellant for rockets, missiles, and fireworks. Perchlorate salts are also used on a large scale as a component of air bag inflators.

Perchlorate began to be discovered at various manufacturing sites and in well-water and drinking water supplies within several months following the

April 1997 development of a low-level (4 ppb) detection method. There are currently 14 states with confirmed releases in ground or surface water and 44 states with confirmed perchlorate manufacturers or users based on U.S. Environmental Protection Agency (EPA) information request responses. In April of 1997, the existing toxicologic database on perchlorate was determined to be inadequate for quantitative human health risk assessment by an external peer review. A lack of data on the ecotoxicological effects was also noted. By May 1997, a testing strategy was developed based on the known mode-of-action for perchlorate toxicity, the inhibition of iodide uptake in the thyroid and subsequent perturbations of thyroid hormone homeostasis. An integrated approach to risk characterization of perchlorate was necessary because uncertainties existed in the toxicological database to adequately address the potential for perchlorate to produce human health/ecotoxicological effects at low levels in drinking water; the actual extent of the occurrence of perchlorate in ground and surface waters, which is compounded by some uncertainty in the validation of the analytical detection method; the efficacy of different treatment technologies for various water uses, such as drinking water or agricultural application; and the extent and nature of ecological impact or transport and transformation phenomena in various media. There is no National Primary Drinking Water Regulation (NPDWR) for perchlorate. Perchlorate was placed on the Office of Water (OW) Contaminant Candidate List in March 1998, with note that additional research and information are required before regulatory determinations can be made.

The development of the toxicology review document and the risk assessment activities regarding perchlorate have been a model for a full and open public process involving several EPA offices, programs, and regions, many other Federal Agencies, States, the industry and the public. Of particular note is the Interagency Perchlorate Steering Committee (IPSC), a working partnership of government agencies chartered to facilitate identification of the issues and coordinate exchange of scientific information related to potential perchlorate contamination in the environment. The IPSC includes representative from the EPA, Department of Defense, Agency for Toxic Substances and Disease Registry, National Institute for Environmental Health Sciences, Native American Tribes and various state agencies. Additional information on the background and current status of various activities regarding perchlorate can be found on the OW website: <http://www.epa.gov/ogwdw/ccl/perchlor/perchlo.html>.

The National Center for Environmental Assessment (NCEA) developed this toxicology review document to revise previous provisional oral reference dose (RfD) values for perchlorate with a more comprehensive data base. The external peer review draft (ERD) of the document presents an updated human health risk assessment of the historical data base together with results of the new health effects studies available as of November 1998 and an ecological assessment of a recent screening test battery. The human health risk assessment model utilized a mode-of-action approach that harmonizes noncancer and cancer approaches to derive a single oral risk benchmark based on precursor effects for both neurodevelopmental and thyroid

neoplasia. Both of these are historically established effects of perturbations in the hypothalamic-pituitary-thyroid feedback system. The oral risk benchmark (RfD), as proposed, is protective of potential cancer because of new perchlorate data on the lack of genotoxicity and the reversibility of thyroid hyperplasia. These data allowed perchlorate to be characterized as an indirect anti-thyroid chemical according to EPA guidance thyroid follicular cell tumors. The proposed oral benchmark is 0.0009mg/kg-day. This value reflects the inclusion of a composite uncertainty factor of 100, although some reviewers suggested that an uncertainty factor of at least 300 would be more consistent with the available data. Although presented as a point estimate, a benchmark value such as this is typically considered to be an average estimate with uncertainty ranging from 3-fold below to 3-fold above. The confidence in the derivation is designated at medium. If standard default body weight (70 kg) and water consumption (2 L/day) values were applied to the benchmark value to derive an action level, the resulting value (32 ppb) would be slightly above the current range of action levels (4 to 18 ppb) based on the previous provisional RfD values. Assessment of ecological screening data suggest that additional research is warranted. The human and ecological assessments may be used in the future to support development of a health advisory or NPDWR and cleanup decisions at hazardous waste sites. No systematic survey of perchlorate occurrence or exposure characterization has yet been made and represents a key data gap in the ability to characterize risk.

An external peer review of the ERD is scheduled for February 10 and 11, 1999 in San Bernardino, California. Details on the peer review can be found on the OW website <http://www.epa.gov/OGWDW/ccl/perchlor/perchlo.html#new>. Copies of the document as well as all supporting information will be available for review at the following locations: EPA Regional Office Superfund Resource Centers; EPA Headquarters Information Resources Center, Washington, DC; the NCEA Offices in Cincinnati, OH and Research Triangle Park, NC; the California Department of Health Services; the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment, and the Operational Toxicology Branch of Wright-Patterson Air Force Base, Dayton, OH.

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## WHAT IS A PERCHLORATE REFERENCE DOSE?

The reference dose is the current best scientific estimate of what constitutes a safe exposure. The initial 3.6 ppb reference dose was from a rudimentary literature review and had very low confidence -- it was a first step in the process and not intended for public consumption. Ideally you would revise your reference dose to a medium confidence level within a year or so after making the initial reference dose, but for political reasons perchlorate has dallied for 8 years between low confidence reference dose and medium confidence

reference dose. Medium confidence reference doses involve an external peer review and are considered good enough for the US EPA to post on the web (IRIS -- Integrated Risk Information System, I think). State and local authorities use IRIS to make up-to-date decisions about toxic contamination. For example, if the reference dose for perchlorate had been 1000 ppb and there were no obvious point sources for ClO<sub>4</sub><sup>-</sup> near Yardley, then Pennsylvania authorities could safely ignore an isolated, transient hit of 2 ppb perchlorate; now that the reference dose is potentially 5 ppb, they are very accountable to you to insure that the 2 ppb is not part of a larger plume.

Theoretically, reference doses only take health considerations into account, while federally enforced Maximum Concentration Levels (MCLs) are political-legal entities that explicitly take economic impact into consideration. Thus you can have a high confidence reference dose for perchlorate that says there is some health risk at 5 ppb, but the MCL may end up to be 18 ppb because you can't shut down Phoenix, Las Vega, Las Angeles, and San Diego just because they have a little ClO<sub>4</sub><sup>-</sup> in their water. Perchlorate, as a new member of the EPA's contaminant candidate list, will be eligible for entering the MCL process in 2003. There's a discussion of all this somewhere on the federal EPA perchlorate page.

I think you can safely interpret the 32 to 5 ppb reference dose range as a firm statement by the feds to the states that they want this stuff monitored so that it's potential health effects can be evaluated epidemiologically. I think the EPA is taking a hard-line because perchlorate exists in the Colorado River where it is concentrating in a vital segment of the nation's food supply. But until I read the supporting studies, I just don't know what caused this low estimate: Last month's presentation showed no lowering of hormone levels in rats below the 1mg/kg/day or 32,000 ppb level. I'm sure the perchlorate industry will argue that the thyroid hyperplasia (cell proliferation) found in rat pups at 3200 ppb is irrelevant to human health risks.

Larry Ladd

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## PERCHLORATE AND LEGAL IMMUNITY

According to <http://www.acwanet.com/legislation/legis/99prior.html>, the Association of California Water Agencies is asking the California legislature to protect perchlorate-impacted water utilities from personal injury suits. Specifically, this protection would apply to the water purveyors affected by the Aerojet perchlorate/tce/nitrosodimethylamine plumes in Rancho Cordova and the San Gabriel Valley. Conspicuously absent is any reference to the Lockheed perchlorate/tce plume in the Santa Ana Valley. This suggests to me the possibility that nitrosodimethylamine, a suspected human carcinogen, is giving the personal injury attorneys their best evidence. The EPA's external peer review for perchlorate toxicology

will be held in San Bernardino, California on February 10-11.

Larry Ladd

Community Representative  
Aerojet Health Assessment Site Team  
Rancho Cordova, California

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## PERCHLORATE PEER REVIEW

> Subject: 64FR2492 Technical Workshop on Perchlorate Risk Issues  
> From: [roboposter@us.govnews.org](mailto:roboposter@us.govnews.org)  
> Date: 1999/01/14  
> Newsgroups: gov.us.topic.environment.announce  
> Archive-Name: gov/us/fed/nara/fed-register/1999/jan/14/64FR2492  
> Posting-number: Volume 64, Issue 9, Page 2492  
>  
> [Federal Register: January 14, 1999 (Volume 64, Number 9)]  
> [Notices]  
> [Page 2492-2493]  
> >From the Federal Register Online via GPO Access [[wais.access.gpo.gov](http://wais.access.gpo.gov)]  
> [DOCID:fr14ja99-65]  
> [[Page 2492]]  
>  
> ENVIRONMENTAL PROTECTION AGENCY  
> [FRL-6219-3]  
> Technical Workshop on Perchlorate Risk Issues  
> AGENCY: Environmental Protection Agency (EPA).  
> ACTION: Notice of meeting.  
>  
> -----  
>  
> SUMMARY: EPA is announcing a workshop convened by the Research Triangle  
> Institute (RTI), an EPA contractor, for external scientific peer review  
> of the EPA draft document entitled "Perchlorate Environmental  
> Contamination: Toxicological Review and Risk Characterization Based on  
> Emerging Information." The workshop will be held in San Bernardino,  
> California, and will be open to members of the public as observers. The  
> peer review, to be conducted by scientists from outside EPA, is being  
> organized to assist in completing the toxicological review and risk  
> characterization of perchlorate, and will include the protocols and  
> reports of recent studies on perchlorate, as well as EPA's draft  
> Toxicological Review document. Stakeholders in the perchlorate issue  
> who have additional information which is relevant to the assessment of  
> the potential health and ecological effects of perchlorate are invited  
> to make a short presentation of this information at the peer review

- > workshop.
- >
- > DATES: The workshop will begin on Wednesday, February 10, 1999 at 8:30
- > a.m. and end on Thursday, February 11, 1999 at 12:30 p.m. Members of
- > the public may attend as observers.
- >
- > ADDRESSES: The meeting will be held at the San Bernardino City Council
- > Chambers, 300 North D Street, San Bernardino, California 92418. Since
- > seating capacity is limited, please contact Ella Darden of RTI, by
- > telephone, at 919-541-7026; by facsimile, at 919-541-7155; or by E-
- > mail, at [ejd@rti.org](mailto:ejd@rti.org), by January 31, 1999 to attend the workshop as an
- > observer. Observers who wish to make a short presentation of
- > information which may be relevant to the assessment of potential health
- > and ecological effects of perchlorate should register to do so with RTI
- > by January 31, 1999.
- >
- > FOR FURTHER INFORMATION CONTACT: For technical and logistical inquiries,
- > contact Ella Darden, Research Triangle Institute, by telephone, at 919-
- > 541-7026; by facsimile, at 919-541-7155; or by E-mail, at [ejd@rti.org](mailto:ejd@rti.org).
- > Copies of the draft Toxicological Review document will be available for
- > inspection on EPA's National Center for Environmental Assessment web
- > site (<http://www.epa.gov/ncea/>), at EPA's Regional Superfund Records
- > Centers, and at the EPA Headquarters Information Resources Center,
- > Washington DC. Inquiries concerning additional opportunities for
- > document review should be directed to Ella Darden at Research Triangle
- > Institute.
- >
- > SUPPLEMENTARY INFORMATION:
- >
- > Background
- >
- > EPA is in the process of conducting a toxicological review for
- > perchlorate, including the development of a revised provisional
- > reference dose (RfD), a cancer assessment, and an ecological
- > assessment. An RfD is an estimate of a daily oral human exposure that
- > will result in no deleterious noncancer effects over a lifetime.
- > Ideally, an RfD is based on an array of endpoints that address
- > potential toxicity during various critical life stages, from developing
- > fetus through adult and reproductive stages. The noncancer, cancer and
- > ecological assessments may be used to support development of a health
- > advisory and/or drinking water regulations and cleanup decisions at
- > hazardous waste sites. In accordance with EPA's 1998 Peer Review
- > Handbook, a key step in the development of the Toxicological Review
- > document for perchlorate is the upcoming external peer review, in the
- > form of a workshop, which will cover protocols for and reports of the
- > recently completed toxicity studies, the Toxicological Review document,
- > and the proposed revised provisional RfD, cancer assessment and
- > ecological assessment in that document.
- > EPA's Superfund Technical Support Center issued a provisional RfD
- > for perchlorate in 1992 and a revised provisional RfD in 1995. The

> provisional RfD values (1992 and 1995) were based on an acute study in  
> which single doses of potassium perchlorate caused the release of  
> iodide from the thyroids of patients with Graves' Disease. The  
> provisional RfD values did not undergo internal Agency, or external,  
> peer review. In March of 1997 a peer review panel convened by an  
> independent organization, Toxicology Excellence for Risk Assessment  
> (TERA), determined that the health effects and toxicity data for  
> perchlorate were insufficient to generate a credible RfD for risk  
> assessment purposes. The reviewers were concerned that developmental  
> toxicity, notably neurological development due to hypothyroidism during  
> pregnancy, could be a critical health effect of perchlorate that has  
> not been adequately examined in studies to date. They also concluded  
> that insufficient data were available on potential effects of  
> perchlorate on organs and tissues other than the thyroid.

> New Health Effects/Toxicology Studies Underway

> As a result of that peer review, a set of toxicological and  
> ecological studies was undertaken is underway to address key data gaps  
> and provide a comprehensive database related to the toxicity of  
> perchlorate. The studies are being funded and overseen by a variety of  
> organizations with potential responsibility for perchlorate  
> contamination in the environment including the United States Air Force,  
> the National Aeronautics and Space Administration and the Perchlorate  
> Study Group (PSG).<SUP>1</SUP>

> \1\ The PSG is a consortium of defense contractors and  
> manufacturers including: Aerojet, Alliant Techsystems, American  
> Pacific/Western Electrochemical Company, Atlantic Research  
> Corporation, Kerr-McGee Chemical Corp. Lockheed Martin, Thiokol  
> Propulsion Group, and United Technologies Chemical Systems.

> To date, a 90-day subchronic oral study, a neurobehavioral  
> developmental toxicity study, genotoxicity studies, a segment II  
> developmental toxicity study, and ecotoxicity studies in Daphnia,  
> earthworms, lettuce and fathead minnow have been completed. Currently  
> ongoing studies include a two-generation reproductive toxicity study,  
> absorption, distribution, metabolism, and elimination (ADME) studies,  
> perchlorate mechanistic studies, and immunotoxicity studies. The  
> results of most of these studies will be discussed in the Toxicological  
> Review document and utilized for development of the proposed revised  
> RfD, and cancer and ecological assessment for perchlorate.  
> Ten independent scientists from the fields of general toxicology,  
> thyroid function and toxicology, developmental toxicology,  
> neurotoxicology, immunotoxicology, pharmacology, genetic toxicology,  
> medical endocrinology with an emphasis on thyroid function,

> biostatistics, assessment of risks due to non-cancer and cancer health  
> effects, and assessment of risks due to ecological effects will review  
> the scientific data, methods, and analyses, along with the assumptions  
> and uncertainties that are associated with the revised provisional RfD,  
> cancer assessment, and ecological assessment for perchlorate. These  
> scientists were selected by RTI from among the experts nominated by  
> stakeholders for possible service as external peer reviewers. Following  
> the peer review workshop, RTI will issue a  
>  
> [[Page 2493]]  
>  
> report summarizing the workshop. EPA will address the comments of the  
> peer reviewers in finalizing the Toxicological Review document for  
> perchlorate and adopting the revised perchlorate RfD. The RfD will be  
> utilized in performing risk assessments of perchlorate contamination in  
> the environment. Although such risk assessments will be one of the  
> factors considered in making future decisions regarding perchlorate  
> contamination, these decisions and other risk management issues will  
> not be a part of the peer review process.  
>  
> Dated: January 7, 1999.  
> Timothy Fields, Jr.,  
> Acting Assistant Administrator, Office of Solid Waste and Emergency  
> Response.  
> [FR Doc. 99-890 Filed 1-13-99; 8:45 am]  
> BILLING CODE 6560-50-P  
>  
> (end of original message)

**64FR2492 EPA's Technical Workshop on Perchlorate Risk Issues** - You can view this message and the related discussion by following this link:

[http://www.dejanews.com/=zzz\\_maf/dnquery.xp?search=thread&svcclass=dnserver&recnum=%3c64FR24](http://www.dejanews.com/=zzz_maf/dnquery.xp?search=thread&svcclass=dnserver&recnum=%3c64FR24)

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## CONGENITAL HYPOTHYROIDISM RATE IN PERCHLORATE CONTAMINATED AREA

I just received the final copy of the U.S. Public Health Service initial health consultation for perchlorate exposure in Rancho Cordova, California. It ends up the congenital hypothyroidism rate in Rancho Cordova's perchlorate-exposed zip code during the likely period of exposure (1990-1996) was 1 case / 1300 births, where the national average is 1/4000. The rate for the state of California in 1980-1989 was 1/3762, while in 1990-1996 it was 1/2842. Approximately one half of all infants currently being born in California are Hispanic. It has always been presumed

California's higher rate was due exclusively to the large Hispanic population, because nationally Hispanics have a higher congenital hypothyroidism rate that is supposed to be at least partly genetic in origin. Given the widespread distribution of low-level perchlorate contamination (5 ppb) in Southern California and Arizona, and the even higher exposure rates (100 ppb) in Hispanic portions of Los Angeles, it's clear that the genetic assumption needs to be re-examined.

In the period 1980-1989, the congenital hypothyroidism rate for Hispanics in California was 1/2808, comparable to the present 1/3000 thyroid birth defect rate for Hispanics in Texas.

Asians generally have the same thyroid birth defect rate as whites, ( 1/4000 - 1/5000) and blacks generally have a much lower rate of congenital hypothyroidism (1/10,000 - 1/30,000). Note that the California-wide rate in the 1990s approximates the Hispanic rate of the 1980s.

Broadly speaking, the exposure to perchlorate in Southern California should reflect income and latitude: the lower the income, the more likely a family would drink tap water, while the lower (more southerly) the latitude, the more likely perchlorate-tainted Colorado River water would be used. The alternative perchlorate-free water source is Sierra Nevada runoff, which enters Southern California from the north via the San Fernando Valley and San Bernardino County. There are two major perchlorate groundwater plumes in Southern California: the San Gabriel River plume, which supplies a densely populated Hispanic area in Los Angeles County, and the Santa Ana River plume in San Bernardino County. The core of the San Bernardino plume is used for agriculture rather than drinking water supply, and Riverside County receives a significant portion of its water from an aqueduct connected to a well field in the San Gabriel mountains.

In 1996-1997 the county-wide congenital hypothyroidism (CH) rates for Southern California were:

County	Cases CH / Births	Ethnicity of Total Population
Los Angeles	1 / 2492	(37% Hispanic, 11% Black)
Orange	1 / 2530	(23% Hispanic, 2% Black)
San Diego	1 / 2686	(20% Hispanic, 6% Black)
San Bernardino	1 / 3037	(26% Hispanic, 8% Black)
Riverside	1 / 3961	(26% Hispanic, 5% Black).

Note that the southern counties of Orange and San Diego have high rates of thyroid birth defects that exceed the 1980s Hispanic rate, and their ethnic mix is roughly comparable with San Bernardino and Riverside counties.

Elsewhere, the thyroid birth defect rate for Sierra-runoff-supplied Sacramento County is 1/4904 (Total population 11% Hispanic, 9% Black) The potentially responsible parties for perchlorate contamination cite Las Vega's recent thyroid birth defect rate of 1/5145 as proof that low levels of perchlorate have no adverse health effects. However, the past level of perchlorate contamination in Las Vegas is much less predictable than in Southern California, because the level of  $\text{ClO}_4^-$  in the Vegas water intake depends on the drift of the currents in Lake Mead. Since last summer Vegas water has been perchlorate-free because of these currents, whereas the well-mixed waters of the Colorado river provide a steady dose of  $\text{ClO}_4^-$  for Southern California.

It should be kept in mind that the recent increase in congenital hypothyroidism statistics in California may be due to factors such as improved screening or false positives from earlier testing times. No conclusions can be reached from such large aggregates of data, but initial inspection does invite a more detailed analysis. On the other hand, if congenital hypothyroidism is linked to the presence of the anti-thyroid peroxidase antibody in the mother as some researchers claim, then a change from a 1/4000 thyroid birth defect rate to a 1/2000 rate might reflect an increase in anti-TPO frequency from 5% to 10% of the childbearing population.

Larry Ladd

Community Representative  
Aerojet Health Assessment Site Team  
Rancho Cordova, California

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## PERCHLORATE EFFECTS ON RAT THYROID

According to a recent EPA report ( the pdf file "Perchlorate Environmental Contamination," found at <http://www.epa.gov/ncea/perch.htm> ), perchlorate affects rat thyroids in the following manner:

.01 mg/kg (350 ppb standard adult dose) induces a 10-20% decline in iodide uptake by the thyroid (page 170 / 5.64). This is roughly the dose found in Rancho Cordova's drinking water.

.1 mg/kg (3500 ppb standard adult dose) induces hypertrophy of thyroid follicular cells and lumen shrinkage in rat pups (page 134 / 5.28). Exposure levels in drinking water may have reached this level during the period of greatest perchlorate dumping (1950's-1960's). This was judged to be the lowest adverse effect from which an uncertainty factor of 100 was applied to determine the reference dose of .0009 mg/kg.

1 mg/kg (35,000 ppb standard adult dose) induces a 10% drop in T3 and T4 hormone levels, with only the T3 being statistically significant. T3 levels drop by 60% at the 3 mg/kg level (p.140 / 5.32).

10 mg/kg (350,000 ppb standard adult dose) induces a significant increase in TSH (p.143 / 5.35), thickening of the corpus callosum in the brain (p.132 / 5.62), and adverse bone marrow effects secondary to endocrine disruption (p. 107 / 5.61).

A key concern is irrigated food crops, with an estimate that produce from the lower Colorado River could contain a dose equivalent to 1.6 mg/kg, or roughly the 50,000 ppb standard adult drinking water dose (page 7.9). Note that the adult standard is a 70 kilogram individual drinking 2 liters of water a day, and that it would take a unusually high consumption of Colorado River fruits and vegetables to approximate the .1 mg/kg level of adverse effect on rat pups. For those who are concerned, these are the food crops irrigated by the lower Colorado: most of the nation's winter lettuce, and a significant portion of the nation's avocados, lemons, and cantaloupes. Grapefruit, watermelon, broccoli, and onion production are also locally important for the west coast market.

Larry Ladd

Community Representative  
Aerojet Health Assessment Site Team  
Rancho Cordova, California

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